OCCURRENCE OF ALDERFLY LARVAE (MEGALOPTERA) IN A WEST VIRGINIA POPULATION OF THE PURPLE PITCHER PLANT, *SARRACENIA PURPUREA* L. (SARRACENIACEAE)[1]

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ABSTRACT: Eight alderfly (Sialidae) larvae were identified in the contents of 99 leaves collected May 14-15, 1994, from a population of the purple pitcher plant, *Sarracenia purpurea*, from Big Run Bog, Tucker County, West Virginia. Five of the larvae were surrounded by mycelia mats. The fungus belonged to the water mold genus, *Saprolegnia* (Saprolegniaceae). Adult alderflies collected from the same locality in June were determined to be *Sialis joppa*. The occurrence of alderfly larvae in pitcher plants is unusual, and probably related to flooding of the habitat.

Alderflies (Sialidae) are a small family of aquatic insects with approximately 23 North American species (Evans, 1984). The predacious aquatic larvae can be abundant in streams, rivers and ponds. Larvae migrate from the water and pupate on dry ground several yards from the water. Adult insects are generally found in the same areas as the immatures. They are usually inactive, resting in the vegetation near their larval habitats. In West Virginia, four species of alderflies have been reported (Tartar *et al.*, 1973; 1978) .

While studying a population of purple pitcher plants, *Sarracenia purpurea L.*, in West Virginia, the contents trapped at the base of several leaves were analyzed by transferring the materials into separate petri dishes. One of the leaves contained a larva approximately 1.0 cm long, which was later identified as belonging to the genus *Sialis* (Sialidae). A study was initiated to determine whether sialid larvae are common to this population of pitcher plants.

This study is significant because it adds to our knowledge of the biology of pitcher plants. Although a variety of species of arthropods are known to be regular inhabitants of these unusual carnivorous plants, it is not clear whether sialid larvae are prey, occasional associates or regular inhabitants.

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METHODS

The *S. purpurea* population is located in Big Run Bog located at 39° 07' N latitude and 79° 35' W longitude, Tucker County, West Virginia at an elevation of 980 m above sea level. The bog occupies approximately 20-25 ha in the Monongahela National Forest (Wieder *et al.* 1981). Big Run Bog (also known as Olson Bog) is dominated by *Sphagnum* and *Polytrichum* which together cover 85% of the surface (Wieder *et al.* 1981). *Sarracenia purpurea* was introduced to this bog in 1946 (Strausbaugh and Core, 1970) and is well established today.

On May 18, 1994 four mature plants were collected for leaf analysis. Individual plants were scooped up by hand, placed in plastic pans with water, covered and transported back to the laboratory at Blackwater Falls State Park. Three additional plants were collected June 14-15, 1994.

During the two visits to the bog in 1994, adult insects were collected using both a sweep net and a beating sheet. In early spring of the next year (March 30, 1995), aquatic specimens were collected using an aquatic insect net from the shallow water in the same vicinity where the pitcher plants had been collected previously. Specimens were preserved in 70% ethanol.

Individual leaves were analyzed after removal from the main cluster by cutting the base with a razor blade. Liquid contents of each leaf were poured into a watch glass. The leaf was then slit lengthwise and folded open. The solid contents at the base of the leaf were removed with a spatula and placed in a vial containing 70% ethanol. Ninety-nine leaves were processed from the May 20, 1994 collections and an additional forty-seven leaves from the June 14, 1994 collections. Each sample was examined under low magnification and alderfly larvae were removed and placed in separate vials.

RESULTS

A total of eight alderfly larvae were identified in the contents of the leaves. All larvae were recovered from the May collections; none was recovered from the June collections. Each of the plants sampled in May had at least one larvae in a leaf sample. Microscopic examination revealed dense mycelial growths attached to the membranous areas of the larvae. The fungus was identified as a species of *Saprolegnia,* a true water mold (Saprolegniaceae) (Coker, 1923).

Although no adult alderflies were collected in May from the sweep net or beating sheet samples, several were collected in June including one adult male. The specimen was identified as *Sialis joppa* Ross. Four species of alderflies have been recorded in West Virginia including *S. joppa* (Tartar *et al.,* 1978).

DISCUSSION

Pitcher plants are usually associated with bogs or swamps and are rather unusual because they exhibit passive carnivory. A number of reports document that *S. purpurea* capture a broad spectrum of insect species as well as other arthropods (Rymal and Folkerts, 1982; Bradshaw and Creelman, 1984). Species found in the pitcher plant may be classified as inhabitants, prey, pitcher plant herbivores or occasional associates. Purplish/red nectar guides lead attracted insects up the brightly colored leaves to the lip where some of them fall into the water-filled reservoir below (Joel, 1986). Pitcher plants rely on a diverse community of bacteria, protozoa and insect larvae for decomposition of trapped prey and absorption of nutrients (Addicott, 1974).

Alderfly larvae have previously been recovered from pitcher plants. Mather (1981) recovered S. *joppa* larvae from a population of S. *purpurea* in New Jersey, one in late April and the other May 30. The collection dates for our material coincide well with the New Jersey collections. No fungal growth on the specimens was reported by Mather. There also was no indication of the number of plants sampled.

The presence of eight sialid larvae in 99 leaf content samples shows that sialid larvae are relatively common insects found in this population of pitcher plants. Since the same species has now been found in two widely dispersed pitcher plant populations, it may be inferred that they are not rare in pitcher plants. Whether sialid larvae are prey is not clear. Five of the larvae exhibited dense growths of *Saprolegnia i*ndicating the specimens were dead when collected. It is not known whether the other two larvae were alive or dead at the time of collection.

Alderflies are generally associated with both lotic and lentic habitats. Mather (1981) suggested that the larvae may have entered the pitcher plant in search of pupation sites. We suggest that in early spring the water level in the bog is higher due to both snow melt and rain. During that time sialid larvae distribute throughout the bog, some moving into pitcher plant leaves where a rich source of dead insects and live Diptera larvae can provide nourishment. As the water level recedes, the sialid larvae become stranded in the leaves. In March, 1995, we attempted to test this hypothesis by collecting aquatic insects from the shallow water in the vicinity of where previous pitcher plant collections had been made. No sialid larvae were recovered.

Miles *et al.,* (1975) reported that a related pitcher plant species, *Sarracenia flava,* produces a number of natural products including two amines, an unusual enol diacetal monoterpene, sarracenin, and coniine, one of the poisonous alkaloids found in hemlock *(Conium maculatum).* The two amines are responsible for paralyzing insects after they become entrapped in the pitcher.

It is possible that coniine, sarracenin, or other toxic amines are present in *S. purpurea.* These or related compounds may immobilize or kill sialid larvae that

enter the pitcher plants. The dead insects may subsequently be invaded by a species of *Saprolegnia* which decomposes the larvae, providing nutrients for the plant.

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